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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 280

Contribution from the Bureau of Biological Survey
HENRY W. HENSHAW, Chief

Washington, D. C. PROFESSIONAL PAPER September 27, 1915

# FOOD HABITS OF THE THRUSHES OF THE UNITED STATES

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By

F. E. L. BEAL, Assistant Biologist

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By F. E. L. Beal, *Assistant Biologist.*

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## INTRODUCTION.

North American thrushes (Turdidæ) constitute a small but interesting group of birds, most of which are of retiring habits but noted as songsters. They consist of the birds commonly known as thrushes, robins, bluebirds, Townsend's solitaire, and the wheatears. The red-winged thrush of Europe (*Turdus musicus*) is accidental in Greenland, and the wheatears (*Saxicola œnanthe* subspp.) are rarely found in the Western Hemisphere except in Arctic America. Within the limits of the United States are 11 species of thrushes, of which the following 6 are discussed in this bulletin: Townsend's solitaire (*Myadestes townsendi*), the wood thrush (*Hylocichla mustelina*), the veery and willow thrush (*Hylocichla fuscescens* subspp.), the gray-cheeked and Bicknell's thrushes (*Hylocichla aliciæ* subspp.), the olive-backed and russet-backed thrushes (*Hylocichla ustulata* subspp.), and the hermit thrushes (*Hylocichla guttata* subspp.). An account of the food habits of the 5 species of robins and bluebirds appeared in Department Bulletin No. 171.

As a group thrushes are plainly colored and seem to be especially adapted to thickly settled rural districts, as the shyest of them, with

Note.—This bulletin treats of the economic relations and value to agriculture of the thrushes of the United States other than robins and bluebirds. These two forms were discussed in Department Bulletin No. 171, issued February 5, 1915.

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the exception of the solitaire, do not require any greater seclusion than that afforded by an acre or two of woodland or swamp.

The thrushes are largely insectivorous, and also are fond of spiders, myriapods, sowbugs, snails, and angleworms. The vegetable portion of their diet consists mostly of berries and other small fruits. As a family thrushes can not be called clean feeders, for the food eaten often contains a considerable proportion of such matter as dead leaves, stems, and other parts of more or less decayed vegetation. It might be supposed that this was gathered from the ground with insects and other food, but investigation shows that much of it has a different origin. It was noticed that the setæ or spines of earthworms were a very common accompaniment of this decayed vegetation. Earthworms themselves are rather rarely found in stomachs, although some birds, as the robin, eat them freely. It is well known that the food of earthworms consists largely of partially decayed vegetable matter found in the soil. Hence it is probable that decayed vegetation found in the stomachs of thrushes is the food contained in the earthworms when they were swallowed. The tissues of worms are quickly digested, leaving the contents of their alimentary canals mixed with the hard indigestible setæ or spines.

Thrushes of the genus *Hylocichla* show a very pronounced taste for ants, and the average consumption of these insects by the five species is 12.65 per cent. Few birds other than woodpeckers show so strong a liking for this highly flavored food. Hymenoptera in general, including ants, bees, and wasps, are the second largest item of insect food. Lepidoptera (caterpillars) stand next as an article of thrush diet, while Orthoptera (grasshoppers), which are a favorite food with most birds, do not seem to appeal much to the thrushes.

The thrushes are pronounced ground feeders, and may often be seen picking small fruit that has fallen to the ground. The vegetable portion of their food (40.72 per cent) is largely composed of fruit, which constitutes over 34 per cent of the total food. Of this 30.88 per cent is made up of wild berries, which outweigh the domestic varieties with every species. In all, 94 species of wild fruits or berries were identified in the stomachs of these birds, although it is not always practicable to identify such material unless seeds or some other characteristic parts are present. As this is not often the case, a considerable portion of the stomach contents must be pronounced "fruit pulp" without further identification; thus probably many more species are eaten than are recorded. Moreover, in the case of some fruits, it is not possible to distinguish species by the seeds, so that many species go unrecognized except as to genus. Domestic fruits are eaten so sparingly by the thrushes here considered as to be of no economic importance.

## TOWNSEND'S SOLITAIRE

(*Myadestes townsendi.*)

Townsend's solitaire, a bird of the far West, is a resident of high mountains and lonely gorges. It is partial to running streams and often builds its nest just above a rushing mountain torrent. It ranges from Alaska through the Sierras south to San Bernardino, Cal., and through the Rockies to Arizona and New Mexico, and occasionally farther east. The species is not evenly distributed over this region, but is restricted to such high mountainous portions as afford its favorite surroundings. As long as it retains these habits the bird will have little or no effect upon the products of husbandry, and its food can have only a scientific interest. The song of this species is said to be at times the finest of any of the thrush family.

As this bird is comparatively rare in settled regions only 41 stomachs are available for determining the character of its food. The most southerly and easterly one was taken in Texas, the most westerly in California, and the most northerly in Wyoming. They are distributed through all the months of the year, although April and May are represented by but one each and December by but two. Every other month has three or more. An investigation based upon such limited material can be considered only as preliminary, but will serve to show some of the more important elements of the food. This was made up of 35.90 per cent of animal matter to 64.10 of vegetable.

*Animal food.*—The animal food consists of insects and spiders, with a few hair worms (*Gordius*) found in one stomach. These last may have been contained in the insects eaten. Among insects, beetles constitute the second largest item (10.74 per cent), but 5.89 per cent of these were the useful predatory ground beetles (Carabidæ). This is not a good showing, but too few stomachs have been examined to allow sweeping conclusions. As evidence that this can not be taken as a fair sample of the bird's food habits it may be stated that all of these beetles were taken in January and October. The one stomach collected in January contained 95 per cent of Carabidæ—the only animal food in it—and 93 per cent of the contents of one October stomach was made up of the same material. Evidently in these cases the bird had found a colony of the beetles and filled up with them. Had they constituted the usual diet of the species they would have appeared in other months and in more stomachs, but in smaller quantities. Other families of beetles are eaten so sparingly as to be of little importance. Scarabæidæ stand the next highest, but they amount to less than 2 per cent of the food.

Lepidoptera (caterpillars) make the largest item in the food of *Myadestes*. Eaten much more regularly than beetles, they probably

are a standard article of diet. They were found in the stomachs collected in every month of the year but four, and a greater number of stomachs would probably show them in every month. The one stomach taken in May contained the maximum (72 per cent). The total for the year is 12.95 per cent. Ants are eaten to the extent of 4.71 per cent, while other Hymenoptera, as bees and wasps, make up less than half of 1 per cent. Diptera (flies) are represented by a mere trace in the stomachs. Observers who have seen this bird in its native haunts testify that it takes a considerable portion of its food on the wing. In view of this fact it seems curious that the two orders of insects most active on the wing (Hymenoptera and Diptera) should be so scantily represented in the food. Hymenoptera are a standard diet with flycatchers and would seem to be the natural food of any bird that feeds upon the wing.

Hemiptera (bugs) were found to the extent of 3.51 per cent of the total food. All were contained in three stomachs taken in March, June, and July. In the July stomach four cicadas, or dog-day flies, constituted the whole contents. Grasshoppers amount to less than 1 per cent and all other insects to but a trifle. Spiders were eaten to the extent of 2.94 per cent of the food and were found in the stomachs taken in seven of the twelve months, and judging from their distribution they are eaten whenever available. A hair snake (*Gordius*) was found in one stomach. Following is a list of insects identified and the number of stomachs in which found:

| COLEOPTERA. | | HEMIPTERA. | |
|---|---|---|---|
| *Amara erratica* | 1 | *Platypedia putnami* | 1 |
| *Aphodius* sp. | 1 | | |
| *Balaninus* sp. | 1 | | |

*Vegetable food.*—The vegetable portion of the food of *Myadestes* is 64.10 per cent of the whole, and 58.70 per cent of this, or more than half the whole food, is classified as wild fruit or berries. These were found in stomachs collected in every month. From the even distribution of this food through the year and from the quantity eaten it is evidently a favorite article of diet. Nothing was found in any of the stomachs that could be identified as cultivated fruit, with the possible exception of a mass of fruit pulp found in one. A few seeds of poison ivy and sumac, with fragments of flowers and a few weed seeds, complete the vegetable food. Following is a list of fruits, seeds, etc., identified, and the number of stomachs in which found:

| | | | |
|---|---|---|---|
| Rocky Mountain cedar (*Juniperus scopulorum*) | 3 | Wild cherries (*Prunus* sp.) | 1 |
| Western cedar (*Juniperus monospermum*) | 1 | Sumac berries (*Rhus* sp.) | 1 |
| Other cedars (*Juniperus* sp.) | 2 | Poison ivy (*Rhus toxicodendron*) | 1 |
| Hackberries (*Celtis occidentalis*) | 1 | Waxwork (*Celastrus* sp.) | 1 |
| Douglas hackberries (*Celtis douglasii*) | 1 | Madrona berries (*Arbutus menziesii*) | 5 |
| Service berries (*Amelanchier* sp.) | 1 | Honeysuckle berries (*Lonicera* sp.) | 1 |
| Rose haws (*Rosa* sp.) | 2 | Elderberries (*Sambucus* sp.) | 1 |
| | | Fruit not further identified | 3 |

*Summary.*—With so small an amount of material it is not safe to draw general conclusions, but in the case of *Myadestes* one point seems clear—the bird's favorite food is small wild fruit, and as long as this is abundant the bird will probably not attack cultivated varieties; but should any portion of the region occupied by the solitaire be cleared of its wild fruit and cultivated species be introduced these would likely be preyed upon. Under such conditions this bird, now perfectly harmless, might inflict considerable damage.

## WOOD THRUSH.

(*Hylocichla mustelina.*)

The wood thrush is distributed over the eastern part of the United States wherever suitable conditions are found. It is a lover of open groves and bushy pastures, and may be found along little-traveled roads and near low bushy swamps. The bird is noted for its sweet song, and many country people who are well acquainted with its notes know little or nothing of the bird itself. Its favorite time for singing is in the early evening at the close of a sultry afternoon when a shower has cooled the air. As a rule, it does not nest in gardens or orchards and is seldom seen about farm buildings. It is strictly migratory, and the greater number pass out of the United States in winter, though a few remain in the Southern States. It usually migrates north in April or early May.

For the investigation of the food habits of the wood thrush 171 stomachs were available. One of these was collected in Florida in January and another in Alabama in February, and these two will be treated separately. The remaining 169 were collected from April to October, and are fairly well distributed over that time. The food consisted of 59.59 per cent of animal matter to 40.41 per cent of vegetable. The greatest quantity of animal food was eaten in April, the month of arrival from the south, and the least in October, the month of the return migration.

*Animal food.*—Beetles, collectively (20.40 per cent), constitute the largest item of animal food. Of these, 2.23 per cent are the predacious ground beetles (Carabidæ), generally considered useful. The remainder belong to several more or less harmful families, of which the May-beetle family (Scarabæidæ) amount to 10.17 per cent. Snout beetles, or weevils (Rhynchophora), are eaten to the extent of 2.16 per cent only, and the wood-boring chick-beetles (Elateridæ) to 2.13 per cent.

Among the various species of these insects were noted the remains of the well-known Colorado potato beetle (*Leptinotarsa decemlineata*), in two stomachs, and *Coptocycla signifera*, also injurious to the potato, in one stomach. Remains of *Otiorhynchus ovatus*, a weevil

destructive to strawberry plants, were found in two stomachs, and in one other a weevil, *Sphenophorus parvulus*, that injures the roots of grass. The well-known white grubs that attack grass roots and a host of other plants are the immature forms of many species of *Lachnosterna*, of several species of *Euphoria* and of *Allorhina nitida*. Of these, remains of *Lachnosterna* were found in 27 stomachs and of *Allorhina* and *Euphoria* in one each.

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FIG. 1.—Wood thrush (*Hylocichla mustelina*).

Lepidoptera (caterpillars) stand next to Coleoptera (beetles) in the animal diet of the wood thrush. Although eaten with a fair degree of regularity during every month of the bird's stay in the north, the most were taken in July (16.32 per cent). The average for the season is 9.42 per cent. Ants as an item of food are third in importance, though if other Hymenoptera were included the order would rank next to beetles. They seem to be a rather favorite food with all birds of the genus *Hylocichla*. With the wood thrush they begin with 18.12 per cent in April and gradually decrease through the summer and disappear in October. The total for the season is 8.89 per cent. Hymenoptera other than ants were eaten with great

regularity (3.86 per cent) throughout the season, but not in large quantities. Diptera (flies) are eaten in small quantities and rather irregularly. Most of them were the long-legged crane flies (Tipulidæ), both in the adult and larval form. The total for the season is 2.70 per cent. Hemiptera (bugs) do not appear to be a favorite food, though a few were taken in all of the seven months except October. The average for the season is only 1.33 per cent. Orthoptera (grasshoppers) are eaten in small quantities until July, after which they form a fair percentage till September. The total consumption amounts to 2.28 per cent of the food. A few other insects make up a fraction of 1 per cent. Spiders and myriapods (thousand-legs) appear to be a favorite food with the wood thrush, constituting in April 20.94 per cent of the food, but gradually decreasing in quantity until September. The aggregate for the year is 8.49 per cent. A few sowbugs (isopods), snails, and earthworms (1.83 per cent) close the account of animal food.

Following is a list of the insects identified in the stomachs of the wood thrush and the number of stomachs in which each was found:

| | |
|---|---|
| HYMENOPTERA. | |
| *Tiphia inornata* | 1 |
| COLEOPTERA. | |
| *Harpalus herbivagus* | 1 |
| *Necrophorus tomentosus* | 1 |
| *Philonthus lomatus* | 1 |
| *Hister abbreviatus* | 1 |
| *Hister depurator* | 1 |
| *Hister americanus* | 2 |
| *Ips quadriguttatus* | 1 |
| *Melanotus americanus* | 1 |
| *Corymbites cylindriformis* | 1 |
| *Agrilus bilineatus* | 1 |
| *Telephorus carolinus* | 1 |
| *Onthophagus striatulus* | 1 |
| *Onthophagus tuberculifrons* | 1 |
| *Onthophagus* sp | 3 |
| *Atænius* sp | 2 |
| *Aphodius granarius* | 1 |
| *Aphodius* sp | 1 |
| *Dichelonycha testacea* | 1 |
| *Dichelonycha* sp | 1 |
| *Lachnosterna* sp | 27 |
| *Liyyrus* sp | 1 |
| *Allorhina nitida* | 1 |
| *Euphoria fulgida* | 1 |
| *Euphoria* sp | 2 |
| *Chrysomela pulchra* | 1 |
| *Lcptinotarsa decemlineata* | 2 |
| *Odontota* sp | 1 |
| *Coptocycla signifera* | 1 |
| *Coptocycla* sp | 1 |
| *Anametus griseus* | 1 |
| *Phyxelis rigidus* | 1 |
| *Otiorhynchus ovatus* | 2 |
| *Tanymecus confertus* | 1 |
| *Pandeletejus hilaris* | 1 |
| *Barypithes pellucidus* | 1 |
| *Listronotus latiusculus* | 1 |
| *Macrops* sp | 1 |
| *Conotrachelus posticatus* | 2 |
| *Acalles carinatus* | 1 |
| *Balaninus* sp | 2 |
| *Eupsalis minuta* | 1 |
| *Sphenophorus parvulus* | 1 |
| HEMIPTERA. | |
| *Nezara hilaris* | 2 |
| ORTHOPTERA. | |
| *Diapheromera femorata* | 1 |
| ISOPTERA. | |
| *Termes flavipes* | 1 |

*Vegetable food.*—More than nine-tenths of the vegetable food of the wood thrush can be included in a single item—fruit. Cultivated fruit, or what was thought to be such, was found in stomachs taken from June to September, inclusive. It was eaten regularly

and moderately, and the total for the season was 3.74 per cent of the whole food. Wild fruits or berries of 22 species were found in 72 stomachs, distributed through every month of the bird's stay at the north. Beginning with 1.18 per cent in April, the quantity gradually increases to 87.17 per cent in October, when it makes more than five-sixths of the whole food. The average for the season is 33.51 per cent. In this investigation *Rubus* seeds (blackberries or raspberries) are always reckoned as cultivated fruit, though probably most often wild. Besides fruit, a few seeds and rose haws were found, which with a little rubbish complete the vegetable food (40.41 per cent).

Following is a list of fruits, seeds, etc., identified and the number of stomachs in which found:

| | | | |
|---|---|---|---|
| Yew berries (*Taxus minor*) | 1 | Woodbine berries (*Psedera quinquefolia*) | 1 |
| False Solomon's seal (*Smilacina racemosa*) | 1 | Frost grapes (*Vitis cordifolia*) | 4 |
| Bayberries (*Myrica carolinensis*) | 1 | Wild sarsaparilla (*Aralia nudicaulis*) | 1 |
| Mulberries (*Morus* sp.) | 10 | Flowering dogwood (*Cornus florida*) | 3 |
| Spiceberries (*Benzoin æstivale*) | 5 | Rough-leaved cornel (*Cornus asperifolia*) | 4 |
| Currants (*Ribes* sp.) | 1 | Dogwood (*Cornus* sp.) | 1 |
| Mountain ash (*Pyrus americanus*) | 2 | Black gum (*Nyssa sylvatica*) | 1 |
| Service berries (*Amelanchier canadensis*) | 2 | Huckleberries (*Gaylussacia* sp.) | 1 |
| Blackberries or raspberries (*Rubus* sp.) | 17 | Blueberries (*Vaccinium* sp.) | 6 |
| Rose haws (*Rosa* sp.) | 1 | French mulberry (*Callicarpa americana*) | 1 |
| Wild black cherries (*Prunus serotina*) | 1 | Black elderberries (*Sambucus canadensis*) | 1 |
| Chokecherries (*Prunus virginiana*) | 7 | Other elderberries (*Sambucus* sp.) | 3 |
| Domestic cherries (*Prunus cerasus*) | 4 | Fruit pulp not further identified | 12 |
| Croton (*Croton* sp.) | 1 | | |
| American holly (*Ilex opaca*) | 2 | | |

Of the two stomachs not included in the foregoing discussion, the one taken in Florida in January contained 93 per cent of wild fruit and 7 per cent of weevils, wasps, and spiders; the one collected in Alabama in February was entirely filled with animal food, of which 88 per cent was caterpillars, 5 per cent May beetles, 6 per cent bugs, and 1 per cent spiders.

*Summary.*—The animal food of the wood thrush includes remarkably few useful insects and contains some very harmful ones, as the Colorado potato beetle and many of the Scarabæidæ, the larval forms of which are the well-known white grubs which are a pest to agriculture in preying upon roots of plants. The vegetable portion of the food contains a small quantity of cultivated fruit, but observation shows that the thrush is in the habit of picking up fallen fruit instead of taking it fresh from the tree. The eating of wild fruit has no economic interest except that it serves to distribute the seeds of many shrubs and trees. There is no occasion to discriminate against this bird in any way. It should be rigidly protected.

## VEERY AND WILLOW THRUSH.

(*Hylocichla fuscescens fuscescens* and *Hylocichla fuscescens salicicola.*)

The veery is distributed over the eastern portion of the United States during migration and breeds in the Northern States as far south as Pennsylvania, and in New England and Canada. In winter it disappears almost entirely from the country, only a few remaining in Florida and perhaps in other Southern States. Its western representative is the willow thrush. Like other thrushes, birds of this species are shy and retiring in disposition, keeping for the most part in the shade of woods or bushy swamps, or building nests in a damp ravine with a brook gurgling past. They have been known, however, to visit orchards and sometimes gardens which are not kept too trim. It is thus evident that the food has little direct economic interest, as this bird does not come in contact with the farmer's crops.

For investigating the food of the species 176 stomachs were available. They were collected during the seven months from April to October, and represent 18 States, the District of Columbia, and Canada. The food separates into 57.27 per cent of animal matter and 42.73 per cent of vegetable. The former consists mostly of remains of insects, and the latter of fruit.

*Animal food.*—Predacious ground beetles (Carabidæ) amount to 0.82 per cent. They are evidently not a preferred food. Beetles in general comprise 14.67 per cent of the food, but no family or other group appears to be distinguished except the Carabidæ, which are conspicuous by their absence. Weevils, or snout beetles, amount to 2.49 per cent, and one stomach contained a specimen of the notorious plum curculio (*Conotrachelus nenuphar*). A number of other harmful beetles were noted, but none are so well known as the plum destroyer. Ants make up 10.35 per cent and are eaten with great regularity. Hymenoptera other than ants amount to only 3.26 per cent, but are eaten regularly throughout the season. Hemiptera (bugs) were eaten to a small extent (1.30 per cent) in the first four months, but they are not seen after July. Exactly the same may be said of Diptera, which total only 0.85 per cent.

Lepidoptera (caterpillars) are, next to Hymenoptera, the favorite insect food. They were eaten in goodly quantities in every month except October. The average for the season is 11.91 per cent. Grasshoppers appear to some extent in every month except April, the greatest consumption taking place in October (24 per cent), but as only small numbers are eaten in the earlier months the aggregate for the year is only 4.91 per cent. A few other insects of various orders

amount to 0.98 per cent. Spiders (6.34 per cent) are eaten regularly and constantly through the season, except that none were taken in October. A few sowbugs, snails, etc. (2.70 per cent), complete the quota of animal food. Following is a list of insects identified and the number of stomachs in which found:

| | |
|---|---|
| HYMENOPTERA. | |
| *Tiphia inornata* | 1 |
| COLEOPTERA. | |
| *Elaphrus ruscarius* | 1 |
| *Anisodactylus harrisi* | 1 |
| *Anisodactylus* sp | 1 |
| *Pterostichus lucublandus* | 1 |
| *Hydrobius fuscipes* | 1 |
| *Ips fasciata* | 1 |
| *Byrrhus murinus* | 1 |
| *Dolopius lateralis* | 2 |
| *Limonius æger* | 1 |
| *Corymbites cylindriformis* | 1 |
| *Corymbites spinosus* | 1 |
| *Cormybites tarsalis* | 1 |
| *Corymbites hieroglyphicus* | 1 |
| *Podabrus flavicollis* | 1 |
| *Telephorus bilineatus* | 2 |
| *Telephorus* sp | 1 |
| *Onthophagus* sp | 2 |
| *Atænius cognatus* | 1 |
| *Aphodius* sp | 3 |
| *Dichelonycha* sp | 2 |
| *Serica sericea* | 1 |
| *Lachnosterna hirticula* | 1 |
| *Lachnosterna* sp | 13 |
| *Chrysomela pulchra* | 3 |
| *Chlamys plicata* | 1 |
| *Typophorus canellus* | 1 |
| *Graphops simplex* | 1 |
| *Graphops* sp | 1 |
| *Calligrapha philadelphica* | 1 |
| *Œdionychis quercata* | 1 |
| *Microrhopala vittata* | 1 |
| *Hormorus undulatus* | 1 |
| *Phyxelis rigidus* | 1 |
| *Otiorhynchus ovatus* | 1 |
| *Neoptochus adspersus* | 1 |
| *Cercopeus chrysorrhœus* | 2 |
| *Barypithes pellucidus* | 2 |
| *Sitones* sp | 2 |
| *Phytonomus nigrirostris* | 2 |
| *Conotrachelus nenuphar* | 1 |
| *Conotrachelus posticatus* | 1 |
| *Tyloderma* sp | 1 |
| *Monarthrum mali* | 1 |
| *Xyloteres politus* | 1 |
| DIPTERA. | |
| *Bibio* sp | 1 |

*Vegetable food.*—The vegetable portion of the food of the species is made up of fruit, with a few seeds and a little miscellaneous matter more or less accidental. Fruit collectively amounts to 35.30 per cent, of which 12.14 per cent was thought to be of cultivated varieties and so recorded, while the remainder, 23.16 per cent, was quite certainly of wild species. This percentage of cultivated fruit is more than three times the record of the wood thrush, while the wild fruit eaten is correspondingly less, as the sum total of the fruit consumed is very nearly the same with both birds. From this percentage of domestic fruit one might infer that the veery was, or might be, a serious menace to fruit growing, but no such complaints have been heard, and it is probable that the species is not numerous enough to damage cultivated crops. A close inspection, however, of the fruit eating of the veery removes all doubts. The cultivated fruit, so called, was in every case either strawberries or *Rubus* fruits, i. e., blackberries or raspberries, and as both of these grow wild and in abundance wherever the veery spends its summer, it is probable that all of the fruit eaten was taken from wild plants, though 12.14 per cent has been conventionally recorded as cultivated.

Besides fruit, the veery eats a few seeds of grasses and weeds and a few of sumac, but none of the poisonous species were found in the stomachs. These seeds (7.25 per cent of the food) were eaten so irregularly as to suggest that they are merely a makeshift taken for want of something better. Rubbish (0.18 per cent), consisting of decayed wood, bits of leaves, plant stems, etc., completes the vegetable food.

Following is a list of the items of vegetable food and the number of stomachs in which found:

| | |
|---|---|
| Yew berries (*Taxus minor*) | 1 |
| Pigeon grass seed (*Chætochloa* sp.) | 1 |
| Rush grass seed (*Sporobolus minor*) | 1 |
| False Solomon's seal (*Smilacina* sp.) | 1 |
| Greenbrier berries (*Smilax* sp.) | 2 |
| Hackberries (*Celtis occidentalis*) | 1 |
| Poke berries (*Phytolacca decandra*) | 3 |
| Spice berries (*Benzoin æstivale*) | 2 |
| Service berries (*Amelanchier canadensis*) | 3 |
| June berries (*Amelanchier* sp.) | 9 |
| Mountain ash (*Pyrus americana*) | 1 |
| Crab apples (*Pyrus* sp.) | 1 |
| Strawberries (*Fragaria* sp.) | 3 |
| Blackberries or raspberries (*Rubus* sp.) | 8 |
| Wild black cherries (*Prunus serotina*) | 1 |
| Bird cherries (*Prunus pennsylvanica*) | 1 |
| Chokecherries (*Prunus virginiana*) | 1 |
| Staghorn sumac (*Rhus hirta*) | 2 |
| Dwarf sumac (*Rhus copallina*) | 1 |
| Three-leaved sumac (*Rhus trilobata*) | 1 |
| Other sumac (*Rhus* sp.) | 1 |
| American holly (*Ilex opaca*) | 1 |
| Woodbine berries (*Psedera quinquefolia*) | 1 |
| White cornel (*Cornus candidissima*) | 2 |
| Alternate-leaved cornel (*Cornus alternifolia*) | 3 |
| Rough-leaved cornel (*Cornus asperifolia*) | 1 |
| Dogwood berries (*Cornus* sp.) | 2 |
| Sour gum berries (*Nyssa sylvatica*) | 1 |
| Huckleberries (*Gaylussacia* sp.) | 1 |
| Blueberries (*Vaccinium* sp.) | 4 |
| Snowberries (*Symphoricarpos racemosus*) | 2 |
| Black elderberries (*Sambucus canadensis*) | 2 |
| Red elderberries (*Sambucus pubens*) | 4 |
| Other elderberries (*Sambucus* sp.) | 3 |
| Fruit pulp not further identified | 4 |

*Summary.*—It is hardly necessary to make a summary of the food of this bird in order to bring out its good points, for it seems to have no others. The animal food includes less than 1 per cent of useful beetles, and the remainder is either harmful or neutral. In the matter of vegetable food there seems to be no chance for criticism, as nature evidently supplies all it needs. The bird has never been harmed, but has been held in high esteem for sentimental reasons; let it also be valued and protected for its economic worth.

## GRAY-CHEEKED AND BICKNELL'S THRUSHES.

(*Hylocichla aliciæ aliciæ* and *Hylocichla aliciæ bicknelli*.)

The gray-cheeked thrush (*H. a. aliciæ*) is found in migration over all the Eastern States, but breeds farther north, beyond our limits. Bicknell's thrush (*H. a. bicknelli*), a closely related form, while having somewhat the same general range, breeds farther south and nests in the mountains of northern New York and New England. Both subspecies have the same general habits as other forms of the genus so far as haunts and choice of residence are concerned, but their far-northern range excludes them from coming into contact with cultivated crops. The species does not seem to be very

abundant anywhere, and consequently only a few stomachs have been received for examination. In all they number but 111 and are very irregularly distributed in time. None were taken in August and only one in July and two in June. From so scanty and unevenly distributed material it is impossible to draw final conclusions, but we can get some idea as to the nature of the bird's food and its economic importance.

The first analysis of the food gives 74.86 per cent of animal matter to 25.14 per cent of vegetable. This is the most animal food found in the stomachs of any bird of the genus *Hylocichla* and the largest but two of any of the thrushes.

*Animal food.*—Beetles collectively amount to about one-third of all the food (33.32 per cent). Of these, 2.83 per cent are the useful Carabidæ. The rest belong to harmful families, such as the Scarabæidæ, Elateridæ, and the weevils, or snout beetles. Ants amount to 16.34 per cent and are eaten very regularly—the most in the early part of the season. Hymenoptera other than ants, as wasps and bees, were eaten to the extent of 5.60 per cent, and with the ants make 21.94 per cent, placing this food next in rank to beetles. As in the case of ants, most of the bees and wasps were eaten in the first three months of the season. No honey bees were found. Lepidoptera (caterpillars) were third in order of abundance (8.81 per cent). No special pest was discovered, but all caterpillars may be considered as harmful. A few grasshoppers were found in the stomachs taken in April and May, and more in those collected in September and October. They do not appear to be a favorite food and amount to only 1.72 per cent. Other insects, as flies, bugs, and a few others, collectively amount to 2.89 per cent. Among these, it is of interest to note in one stomach the remains of the famous seventeen-year locust (*Tibicen septemdecem*), rather large game for so small a bird. Spiders are freely eaten by the gray-cheeked thrush in spring, and sparingly in fall. For the season they constitute 5.77 per cent of the food. A few other animals, as crawfish, sowbugs, and angleworms (0.41 per cent), complete the animal food.

Following is a list of the insects identified and the number of stomachs in which found:

| | | | |
|---|---|---|---|
| HYMENOPTERA. | | *Stelidota 8-maculata* | 1 |
| *Lophyrus*, sp | 1 | *Byrrhus murinus* | 1 |
| *Aphænogaster tennesseensc* | 1 | *Eucinetus morio* | 1 |
| | | *Monocrepidius vespertinus* | 1 |
| COLEOPTERA. | | *Agriotes limosus* | 1 |
| | | *Corymbites signaticollis* | 1 |
| *Cychrus andrewsi* | 2 | *Podabrus flavicollis* | 1 |
| *Cychrus* sp | 2 | *Telephorus bilineatus* | 1 |
| *Dyschirius hispidus* | 1 | *Onthophagus* sp | 1 |
| *Hister sedecimstriatus* | 1 | *Atænius strigatus* | 1 |
| *Phelister vernus* | 1 | *Atænius ovatulus* | 1 |
| *Epuræa rufa* | 3 | *Atænius* sp | 3 |

| | |
|---|---|
| *Aphodius rurícola* | 1 |
| *Aphodius inquinatus* | 3 |
| *Aphodius* sp | 1 |
| *Serica* sp | 1 |
| *Lachnosterna* sp | 10 |
| *Anomala* sp | 1 |
| *Leptura sphæricollis* | 1 |
| *Leptura mutabilis* | 1 |
| *Chrysomela pulchra* | 4 |
| *Blapstinus metallicus* | 1 |
| *Helops micans* | 1 |
| *Hormorus undulatus* | 1 |
| *Otiorhynchus ovatus* | 1 |
| *Cercopeus chrysorrhœus* | 2 |
| *Pandeletejus hilaris* | 1 |
| *Sitones* sp | 1 |
| *Hylobius pales* | 1 |
| *Desmoris constrictus* | 1 |
| *Bagous sellatus* | 1 |
| *Anthonomus sycophanta* | 1 |
| *Conotrachelus posticatus* | 2 |
| *Acalles clavatus* | 1 |
| *Acalles* sp | 1 |
| *Cryptorhynchus ferratus* | 1 |
| *Sphenophorus melanocephalus* | 1 |
| HEMIPTERA. | |
| *Tibicen septendecem* | 1 |
| *Nezara hilaris* | 1 |

*Vegetable food.*—A few *Rubus* seeds were recorded as cultivated fruit, but they were found in only two stomachs and probably were wild, as the gray-cheeked thrush does not live where it is likely to come in contact with cultivated blackberries or raspberries. In any case they amount to only 0.15 per cent. Wild fruits of 18 different species (23.98 per cent) make up nearly one-fourth of the whole food—in fact, the vegetable food, other than wild fruit, is insignificant. Wild berries supplement the regular food, which consists of insects and spiders.

The following list shows the fruits and seeds identified and the number of stomachs in which found:

| | |
|---|---|
| False spikenard (*Smilacina racemosa*) | 1 |
| Greenbrier berries (*Smilax* sp.) | 2 |
| Bayberries (*Myrica carolinensis*) | 1 |
| Poke berries (*Phytolacca decandra*) | 2 |
| Crab apples (*Pyrus* sp.) | 1 |
| Wild black cherries (*Prunus serotina*) | 5 |
| Blackberries or raspberries (*Rubus* sp.) | 2 |
| Sumac berries (*Rhus* sp.) | 1 |
| Black-alder berries (*Ilex verticillata*) | 1 |
| Wild grapes (*Vitis* sp.) | 3 |
| Wild sarsaparilla (*Aralia* sp.) | 1 |
| Flowering dogwood (*Cornus florida*) | 5 |
| Rough-leaved dogwood (*Cornus asperifolia*) | 2 |
| White cornel (*Cornus candidissima*) | 1 |
| Dogwood (*Cornus* sp.) | 1 |
| Sour gum (*Nyssa sylvatica*) | 2 |
| Black nightshade (*Solanum nigrum*) | 1 |
| Dockmackie (*Viburnum acerifolium*) | 1 |
| Arrowwood (*Viburnum* sp.) | 1 |
| Elderberries (*Sambucus canadensis*) | 3 |
| Fruit not further identified | 6 |

*Summary.*—In the food of the gray-cheeked thrush the only useful element is a small percentage (2.83) of useful beetles. The remainder of the animal food is composed of either harmful or neutral elements. The vegetable food, drawn entirely from nature's great storehouse, contains no product of human industry, either of grain or fruit. Whatever the sentimental reasons for protecting this bird, the economic ones are equally valid.

## OLIVE-BACKED AND RUSSET-BACKED THRUSHES.

(*Hylocichla ustulata swainsoni* and *Hylocichla ustulata ustulata*.)

The olive-backed thrush and its relative, the russet-backed, occupy the whole of the United States at some time during the year. The olive-back breeds north of our northern border, except in the higher mountains, and the russet-back on the Pacific coast nests as far

south as southern California. The habits of birds of this species resemble those of others of the genus in living in swamps and woodlands rather than in gardens and orchards. The russet-back on the Pacific coast, however, seems to have become quite domestic, and wherever a stream runs through or past an orchard or garden, or the orchard is near thick chaparral, this bird is sure to be found taking its toll of the fruit and rearing its young in the thicket beside the stream. During the cherry season it takes a liberal share of the fruit, but its young, then in the nest, are fed almost entirely on insects. The eastern subspecies, on the contrary, does not come in contact with domestic fruit or any other product of husbandry. A great number of the subspecies nest far north of the region of fruit raising.

For this investigation 403 stomachs of the olive-backed thrush were available, collected in 25 States, the District of Columbia, and Canada. Florida, Louisiana, and Texas represent the most southern collections and New Brunswick, Ontario, and Northwest Territory the most northern. In California 157 stomachs were obtained, which, with those taken in Oregon and Washington, fairly represent the Pacific coast region. The whole collection was fairly well distributed over the nine months from March to November. The food consisted of 63.52 per cent of animal matter to 36.48 per cent of vegetable.

*Animal food.*—Beetles of all kinds amount to 16.29 per cent. Of these 3.14 per cent are the useful Carabidæ. The others belong to harmful or neutral families. Weevils or snout beetles (Rhynchophora) amount to 5.29 per cent, a high percentage for such insects. One Colorado potato beetle (*Leptinotarsa decemlineata*) was found in a stomach taken on Long Island. Hymenoptera collectively aggregate 21.50 per cent. Of these, 15.20 per cent are ants—a favorite food of *Hylocichla*. The remainder (6.30 per cent) were wild bees and wasps. No honeybees were found. Caterpillars, which rank next in importance in the food of the olive-back, form a good percentage of the food of every month represented and aggregate 10.30 per cent for the season.

Grasshoppers are not an important element in the food of thrushes, as they chiefly inhabit open areas, while *Hylocichla* prefers thick damp cover, where grasshoppers are not found. An inspection of the record shows that most of the orthopterous food taken by the olive-back consists of crickets, whose habits are widely different from those of grasshoppers, and which are found under stones, old logs, or dead herbage. The greatest quantity is taken in August and September. The average for the season is 2.42 per cent.

Diptera (flies) reach the rather surprisingly large figure of 6.23 per cent. These insects are usually not eaten to any great extent

except by flycatchers and swallows, which take their food upon the wing. The flies eaten by the olive-back are mostly crane flies (Tipulidæ) or March flies (*Bibio*), both in the adult and larval state. Crane flies are slow of wing and frequent shady places. The larvæ of both groups are developed in moist ground, and often in colonies of several hundred. With these habits it is not surprising that they fall an easy prey to the thrushes.

Hemiptera (bugs), a small but rather constant element of the food, were found in the stomachs collected every month, and in July reach 11.11 per cent. They were of the families of stinkbugs (Pentatomidæ), shield bugs (Scutelleridæ), tree hoppers (Membracidæ), leaf hoppers (Jassidæ), and cicadas. Some scales were found in one stomach. The total for the season is 3.76 per cent. A few insects not included in any of the foregoing categories make up 0.48 per cent of the food. Spiders, with a few millipeds, amount to 2.22 per cent, the lowest figure for this item of any bird of the genus *Hylocichla*. Snails, sowbugs, angleworms, etc. (0.32 per cent), complete the animal food.

Following is a list of insects identified and the number of stomachs in which found:

HYMENOPTERA.

| | |
|---|---|
| *Camponotus pennsylvanicus* | 1 |
| *Tiphia inornata* | 1 |

COLEOPTERA.

| | |
|---|---|
| *Cychrus nitidicollis* | 1 |
| *Cychrus stenostomus* | 1 |
| *Notiophilus æneus* | 1 |
| *Pterostichus sayi* | 1 |
| *Pterostichus lustrans* | 1 |
| *Amara interstitialis* | 1 |
| *Triæna longula* | 1 |
| *Agonoderus pallipes* | 1 |
| *Silpha ramosa* | 1 |
| *Staphylinus cinnamopterus* | 1 |
| *Tachyporus californicus* | 1 |
| *Chilocorus orbus* | 1 |
| *Scymnus* sp | 1 |
| *Hister americanus* | 1 |
| *Ips quadriguttatus* | 4 |
| *Cytilus sericeus* | 1 |
| *Agriotes stabilis* | 1 |
| *Podabrus flavicollis* | 2 |
| *Podabrus modestus* | 2 |
| *Silis lutea* | 1 |
| *Telephorus carolinus* | 1 |
| *Telephorus bilineatus* | 5 |
| *Telephorus divisus* | 2 |
| *Onthophagus hecate* | 1 |
| *Onthophagus striatulus* | 1 |
| *Onthophagus tuberculifrons* | 2 |
| *Onthophagus* sp | 4 |
| *Atænius abditus* | 1 |
| *Aphodius hamatus* | 1 |
| *Aphodius fimetarius* | 6 |
| *Aphodius inquinatus* | 7 |
| *Aphodius* sp | 6 |
| *Geotrupes* sp | 1 |
| *Dichelonycha elongata* | 2 |
| *Lachnosterna hirticula* | 1 |
| *Lachnosterna* sp | 12 |
| *Anomala undulata* | 1 |
| *Anomala* sp | 1 |
| *Euphoria fulgida* | 1 |
| *Donacia emarginata* | 1 |
| *Hæmonia nigricornis* | 1 |
| *Syneta pallida* | 1 |
| *Leptinotarsa decemlineata* | 1 |
| *Gastroidea* sp | 1 |
| *Galerucella decora* | 1 |
| *Diabrotica soror* | 1 |
| *Diabrotica* sp | 1 |
| *Gonioctena pallida* | 1 |
| *Luperodes bivittatus* | 1 |
| *Opatrinus notus* | 1 |
| *Blapstinus metallicus* | 1 |
| *Blapstinus mœstus* | 1 |
| *Blapstinus* sp | 1 |
| *Otiorhynchus ovatus* | 1 |
| *Thinoxenus* sp | 1 |
| *Cercopeus chrysorrhœus* | 1 |
| *Barypithes pellucidus* | 1 |
| *Sitones flavescens* | 1 |
| *Sitones* sp | 1 |
| *Phytonomus punctatus* | 2 |
| *Pachylobius picivorus* | 1 |
| *Conotrachelus posticatus* | 1 |
| *Micromastus elegans* | 1 |
| *Acalles clavatus* | 1 |
| *Cryptorhynchus bisignatus* | 1 |
| *Rhinoncus pyrrhopus* | 1 |

| | |
|---|---|
| *Balaninus* sp. | 3 |
| *Sphenophorus parvulus* | 1 |
| *Sphenophorus* sp. | 1 |
| *Scolytus muticus* | 1 |
| **LEPIDOPTERA.** | |
| *Edema albifrons* | 1 |
| **TRICHOPTERA.** | |
| *Phryganea californica* | 1 |
| **HEMIPTERA.** | |
| *Myodocha serripes* | 1 |
| *Sinea diadema* | 1 |

This list of insects contains a considerable number of injurious species and some that at various times and places have become decided pests. Such are the Colorado potato beetle (*Leptinotarsa decemlineata*), the spotted squash beetle (*Diabrotica soror*), the cloverleaf weevil (*Phytonomus punctatus*), and the various species of *Lachnosterna*, the parent of the destructive white grubs. Many others are plant feeders and may increase to such an extent as to inflict great damage upon agriculture.

*Vegetable food.*—The vegetable food of the olive-backed thrush consists of small fruit. The bird has a weak bill and can not break through the tough skin of the larger kinds. In the cherry orchards of California the writer many times observed the western subspecies of this bird, the russet-back, on the ground pecking at cherries that had been bitten open and dropped by linnets and grosbeaks. Blackberries and raspberries have a very delicate skin and are successfully managed by weak-billed birds, so that all the records of domestic fruit eaten by the eastern form relate to these berries, and it is probable that in most cases the fruit was not cultivated. The total of cultivated fruit for the season is 12.63 per cent of the whole food, but if we consider the eastern subspecies alone this item would practically disappear. Wild fruit (19.73 per cent) is eaten regularly and in a goodly quantity in every month after April. Weed seeds and a few miscellaneous items of vegetable food (4.04 per cent) close the account.

Following is a list of vegetable foods so far as identified and the number of stomachs in which found:

| | | | |
|---|---|---|---|
| White cedar seeds (*Thuja occidentalis*) | 1 | Bird cherries (*Prunus pennsylvanica*) | 2 |
| Red cedar berries (*Juniperus communis*) | 2 | Domestic cherries (*Prunus cerasus*) | 29 |
| False Solomon's seal (*Smilacina trifolia*) | 3 | Domestic plum (*Prunus domestica*) | 2 |
| Greenbrier (*Smilax tamnifolia*) | 1 | Apricot (*Prunus armeniaca*) | 3 |
| Cat brier (*Smilax* sp.) | 1 | Filaree (*Erodium* sp.) | 1 |
| Hackberry (*Celtis occidentalis*) | 3 | Poison oak (*Rhus diversiloba*) | 4 |
| Mulberry (*Morus* sp.) | 2 | Staghorn sumac (*Rhus hirta*) | 2 |
| Fig (*Ficus* sp.) | 3 | Dwarf sumac (*Rhus copallina*) | 3 |
| Pale persicaria (*Polygonum lapathifolium*) | 1 | Other sumac (*Rhus* sp.) | 4 |
| Poke berries (*Phytolacca decandra*) | 9 | Pepper tree (*Schinus molle*) | 1 |
| Mountain ash (*Pyrus americana*) | 1 | American holly (*Ilex opaca*) | 1 |
| Service berries (*Amelanchier* sp.) | 1 | Black alder (*Ilex verticillata*) | 1 |
| Blackberries or raspberries (*Rubus* sp.) | 67 | Coffee berries (*Rhamnus californicus*) | 3 |
| Rose haws (*Rosa* sp.) | 1 | Woodbine (*Psedera quinquefolia*) | 10 |
| Wild black cherries (*Prunus serotina*) | 15 | Frost grape (*Vitis cordifolia*) | 6 |
| | | Spikenard (*Aralia racemosa*) | 2 |
| | | Flowering dogwood (*Cornus florida*) | 7 |
| | | Kinnikinnik (*Cornus amomum*) | 2 |

| | | | |
|---|---|---|---|
| Red osier (*Cornus stolonifera*) | 1 | Snowberries (*Symphoricarpos racemosus*) | 2 |
| Panicled cornel (*Cornus paniculata*) | 3 | Dockmackie (*Viburnum accrifolium*) | 1 |
| Dogwood unidentified (*Cornus* sp.) | 6 | Arrowwood (*Viburnum* sp.) | 1 |
| Huckleberries (*Gaylussacia* sp.) | 1 | Black elderberries (*Sambucus canadensis*) | 6 |
| Three-flowered nightshade (*Solanum triflorum*) | 1 | Red elderberries (*Sambucus pubens*) | 5 |
| Nightshade unidentified (*Solanum* sp.) | 8 | Blue elderberries (*Sambucus glauca*) | 15 |
| Black twinberries (*Lonicera involucrata*) | 2 | Tarweed (*Madia* sp.) | 1 |
| Honeysuckle berries (*Lonicera* sp.) | 2 | Fruit pulp not further identified | 17 |

*Food of young of russet-backed thrush.*—Before concluding the discussion of this species it will be of interest to note the results obtained from an investigation of stomachs of 25 nestlings of the russet-back taken in June and July when the birds were from two to eleven days old. These were from eight broods, ranging from three to five nestlings to the brood. The percentage of animal food of the young (92.60 per cent) is considerably higher than that of the parent birds.

The distribution of the animal food is as follows: Caterpillars were found in every stomach but seven and aggregated nearly 27 per cent; beetles, including the useful Carabidæ (7.7 per cent), are irregularly distributed to the extent of 22 per cent; other more or less harmful species included five families of (Hemiptera) bugs, 13.8 per cent, viz, stinkbugs, leaf hoppers, tree hoppers, shield bugs, and cicadas; ants and a few other Hymenoptera amount to 12 per cent, and spiders the same. These latter were mostly harvestmen or daddy longlegs (Phalangidæ). The remainder (6 per cent) included a few miscellaneous insects. Only three stomachs contained remains of grasshoppers. Carabid beetles were eaten by the young birds to the extent of 7.7 per cent, which is more than three times the amount eaten by the adults, a remarkable fact when is considered that these insects are very hard shelled, thus seemingly unsuited for young birds.

The vegetable food consisted of fruit (6.8 per cent), mainly blackberries or raspberries, found in 11 stomachs, and twinberries in 1, and two or three other items, including a seed of filaree and some rubbish. From the irregular variety of food in the different stomachs, it would seem that the parents make little selection, but fill the gaping mouths of their young with the nearest obtainable supply.

In addition to the examination of stomach contents of nestlings two nests were carefully and regularly watched, and from these it was determined that the parent birds fed each nestling 48 times in 14 hours of daylight. This means 144 feedings as a day's work for the parents for a brood of three nestlings, and that each stomach was filled to its full capacity several times daily, an illustration that the digestion and assimilation of birds, especially the young, are constant and very rapid. Experiments in raising young birds have

proved that they thrive best when fed small quantities at short intervals rather than greater quantities at longer periods. Aside from the insects consumed by the parents, a brood of three young birds will thus each require the destruction of at least 144 insects in a day and probably a very much greater number.

*Summary.*—In a résumé of the food of the olive-backed and russet-backed thrushes one is impressed with the fact that they come in contact with the products of industry but rarely. The olive-back's food habits infringe upon the dominion of man but little. The bird lives among men, but not with them. The western form, the russet-back, comes more into relations with the cultivated products because it visits orchards and partakes freely of the fruit. Even then the damage is slight, as much of the fruit eaten is that fallen to the ground. Moreover, while the adult bird is feeding upon fruit a nestful of young are being reared upon insects which must be largely taken from the orchard, thus not only squaring the account but probably overbalancing it in favor of the farmer.

## HERMIT THRUSHES.

(*Hylocichla guttata* subspp.)

The hermit thrush of the subspecies *H. g. pallasi* inhabits the Eastern States in winter as far north as Massachusetts and breeds from the mountains of Maryland and Pennsylvania and from northern Michigan and central Minnesota northward to Alaska. Several other subspecies occupy the Pacific coast region in suitable localities—that is, in the higher and more wooded sections, as this bird, like all of the genus *Hylocichla*, does not live in treeless or arid regions. In the East the bird is a late fall migrant and may often be seen sitting silent and alone on a branch in the forest in late October or even in November, when the great army of migrants have passed on to the South. While a beautiful songster, the species is so quiet and unobtrusive that by sight it is entirely unknown to many.

Inquiry into the food habits of this bird covered 551 stomachs, collected in 29 States, the District of Columbia, and Canada, and representing every month of the year, though all the stomachs taken in winter were collected in the Southern States the District of Columbia, and California. In the primary analysis the food was found to consist of 64.51 per cent of animal matter to 35.49 per cent of vegetable. The former is mostly composed of insects with some spiders, while the latter is largely fruit, chiefly wild species.

*Animal food.*—Beetles constitute 15.13 per cent of the food. Of these 2.98 per cent are of the useful family, Carabidæ. The remainder are mostly harmful. Scarabæidæ, the larvæ of which are the

white grubs that destroy the roots of so many plants, were eaten to the extent of 3.44 per cent. Snout beetles, among the most harmful of insects, were taken to the extent of 3.13 per cent. Among these was the notorious plum curculio (*Conotrachelus nenuphar*) found in two stomachs taken in the District of Columbia in April of different years. Two other species of the same genus also were found, as well as the clover weevil (*Epicærus imbricatus*). The Colorado potato beetle (*Leptinotarsa decemlineata*) and the striped squash beetle (*Diabrotica vittata*), with a number of other species of less notoriety, were found in several stomachs. Thus, in spite of the bird's retiring habits, it comes in contact with some of the pests of cultivation.

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FIG. 2.—Hermit thrush (*Hylocichla guttata*).

The ants destroyed—12.46 per cent of the food—keep up the reputation of thrushes as ant eaters. They were taken constantly every month, with the greatest number from May to September; a falling off in July is partly accounted for by the fact that more fruit is taken in that month. Other Hymenoptera (bees and wasps) were eaten to the extent of 5.41 per cent, a suprising amount for a bird that feeds so largely upon the ground, as these insects are usually of fleet wing and live in sunshine and open air.

Caterpillars, eaten in every month and mostly in goodly quantities, appear to be a favorite food of the hermit thrush. December is the month of least consumption (2.75 per cent), while the most were eaten in June (17.08 per cent). The average for the year is 9.54 per cent. Hemiptera (bugs) seem to be eaten whenever found, as they appear in the food of every month, but rather irregularly and not in large quantities. The greatest consumption was in June (9.17 per cent), but July, September, and December show the least (less than 1 per cent). The total for the year is 3.63 per cent. Of the six families represented, the Pentatomidæ, or stink bugs, predominate. These highly flavored insects are eaten by most insectivorous birds often, but usually in small quantities.

Diptera (flies) comprise 3.02 per cent of the food of the hermit thrush. The record shows, however, that nearly all of them are either crane flies (Tipulidæ) and their eggs and larvæ, or March flies (*Bibio*) and their larvæ. Over 150 of the latter were found in one stomach. Both of these families of flies lay their eggs in the ground, which accounts for their consumption by ground-feeding birds. Orthoptera (grasshoppers and crickets) are eaten by the hermit thrush to the extent of 6.32 per cent of its food. While this figure is not remarkable, it is the highest for any of the genus. These birds are fond of dark moist nooks among trees and bushes and do not feed extensively in those dry sunshiny places so much frequented by grasshoppers. A close inspection of the food record shows that the Orthoptera eaten by the thrushes are mostly crickets, which live in shadier and moister places than those where grasshoppers abound. A few miscellaneous insects (0.27 per cent) close the insect account. Spiders and myriapods (7.47 per cent) seem to constitute a very acceptable article of diet, as they amount to a considerable percentage in nearly every month, and in May rise to 20.79 per cent. A few miscellaneous animals, as sowbugs, snails, and angleworms, make up the balance of the animal food (1.26 per cent).

Following is a list of insects so far as identified and the number of stomachs in which found:

| | |
|---|---|
| HYMENOPTERA. | |
| *Tiphia inornata* | 2 |
| COLEOPTERA. | |
| *Elaphrus* sp | 1 |
| *Notiophilus semistriatus* | 1 |
| *Scarites subterrancus* | 1 |
| *Dyschirius pumilis* | 1 |
| *Pterostichus patruelis* | 1 |
| *Pterostichus* sp | 1 |
| *Amara* sp | 1 |
| *Chlænius pennsylvanicus* | 2 |
| *Stenolophus* sp | 1 |
| *Anisodactylus agilis* | 1 |
| *Tropisternus limbalis* | 2 |
| *Hydrocharis obtusatus* | 1 |
| *Sphæridium lecontei* | 1 |
| *Ptomaphagus consobrinus* | 1 |
| *Anisotoma valida* | 1 |
| *Megilla maculata* | 1 |
| *Anatis 15-maculata* | 1 |
| *Psyllobora tædata* | 1 |
| *Brachycantha ursina* | 1 |
| *Endomychus biguttatus* | 1 |
| *Cryptophagus* sp | 1 |
| *Hister marginicollis* | 1 |
| *Hister americanus* | 1 |
| *Saprinus fimbriatus* | 1 |
| *Carpophilus hemipterus* | 1 |

| | |
|---|---|
| *Perthalycra murrayi* | 1 |
| *Ips quadriguttatus* | 3 |
| *Cytilus sericeus* | 2 |
| *Cytilus* sp | 1 |
| *Byrrhus kirbyi* | 1 |
| *Byrrhus cyclophorus* | 1 |
| *Cryptohypnus bicolor* | 2 |
| *Drasterius dorsalis* | 1 |
| *Dolopius lateralis* | 1 |
| *Melanotus* sp | 2 |
| *Podabrus tomentosus* | 1 |
| *Canthon* sp | 1 |
| *Onthophagus tuberculifrons* | 1 |
| *Onthophagus* sp | 3 |
| *Ægialia lacustris* | 1 |
| *Rhyssemus scaber* | 1 |
| *Atænius abditus* | 1 |
| *Atænius cognatus* | 1 |
| *Atænius* sp | 1 |
| *Aphodius fimetarius* | 11 |
| *Aphodius granarius* | 1 |
| *Aphodius rugifrons* | 1 |
| *Aphodius inquinatus* | 9 |
| *Aphodius pardalis* | 1 |
| *Aphodius prodromus* | 4 |
| *Aphodius crassiusculus* | 1 |
| *Aphodius* sp | 11 |
| *Geotrupes semipunctata* | 1 |
| *Dichelonycha* sp | 1 |
| *Lachnosterna* sp | 17 |
| *Chrysomela pulchra* | 3 |
| *Lema nigrovittata* | 1 |
| *Chlamys plicata* | 1 |
| *Myochrous denticollis* | 2 |
| *Xanthonia 10-notata* | 1 |
| *Calligrapha scalaris* | 1 |
| *Leptinotarsa decemlineata* | 1 |
| *Phædon viridis* | 1 |
| *Diabrotica vittata* | 1 |
| *Odontota rubra* | 1 |
| *Odontota* sp | 1 |
| *Haltica torquata* | 1 |
| *Crepidodera helxines* | 1 |
| *Syneta ferruginea* | 1 |
| *Systena elongata* | 1 |
| *Chætocnema pulicaria* | 1 |
| *Psylliodes punctulata* | 1 |
| *Chelymorpha cribraria* | 1 |
| *Opatrinus notus* | 1 |
| *Opatrinus aciculatus* | 1 |
| *Blapstinus metallicus* | 1 |
| *Blapstinus rufipes* | 1 |
| *Salpingus virescens* | 1 |
| *Anthicus pubescens* | 1 |
| *Notoxus monodon* | 1 |
| *Notoxus denudatum* | 1 |
| *Notoxus* sp | 1 |
| *Attelabus rhois* | 1 |
| *Rhigopsis effracta* | 1 |
| *Cercopeus chrysorrhœus* | 4 |
| *Pandeletejus hilaris* | 1 |
| *Barypithes pellucidus* | 1 |
| *Sitones hispidulus* | 4 |
| *Sitones flavescens* | 1 |
| *Trichalophus alternatus* | 1 |
| *Apion* sp | 1 |
| *Listronotus latiusculus* | 1 |
| *Listronotus inæqualipennis* | 1 |
| *Listronotus* sp | 1 |
| *Macrops* sp | 2 |
| *Smicronyx corniculatus* | 1 |
| *Trachodes ptinoides* | 1 |
| *Conotrachelus nenuphar* | 2 |
| *Conotrachelus posticatus* | 5 |
| *Conotrachelus crinaceus* | 1 |
| *Rhinoncus pyrrhopus* | 1 |
| *Onychobaris insidiosus* | 1 |
| *Balaninus nasicus* | 1 |
| *Balaninus* sp | 1 |
| *Sphenophorus parvulus* | 1 |
| *Sphenophorus* sp | 1 |
| *Dendroctonus terebrans* | 1 |
| HEMIPTERA. | |
| *Podops cinctipes* | 1 |
| *Nezara hilaris* | 6 |
| *Arhaphe cicindeloides* | 1 |
| *Corimelæna denudata* | 1 |
| *Myodocha serripes* | 2 |
| ORTHOPTERA. | |
| *Amblycorypha rotundifolia* | 1 |
| *Œcanthus niveus* | 1 |

*Vegetable food.*—The vegetable diet of the hermit thrush consists largely of fruit, as with most birds of this group. As might be expected of a bird of such retiring habits, but little of the fruit eaten can be classed as cultivated. In September 5.45 per cent was so considered, but in most months the quantity was small, and in March, April, and May was completely wanting. The total for the year as found in 17 stomachs is 1.20 per cent. One stomach contained strawberries, one grapes, one figs, one currants, two apples, and the rest *Rubus* fruit, i. e., blackberries or raspberries. These last as well as the strawberries were probably wild. Of the wild fruit (26.19 per cent) 46 species were identified with a reasonable degree of certainty in 243 stomachs. A few seeds, ground-up vegetable matter

not further identified, and rubbish make up the rest of the vegetable food (8.10 per cent). Among the seeds were some of the various species of poisonous *Rhus*. These were found in 18 stomachs, mostly from California. The dissemination of these seeds is unfortunate from the standpoint of husbandry, but many birds engage in it, as the waxy coating of the seeds is nutritious, especially in winter, when fruit and insects are not easily obtainable.

Following is a list of the components of the vegetable food so far as identified, and the number of stomachs in which found:

| | |
|---|---|
| Cedar berries (*Juniperus virginiana*) | 2 |
| False Solomon's seal (*Smilacina racemosa*) | 4 |
| False spikenard (*Smilacina* sp.) | 1 |
| Greenbrier (*Smilax walteri*) | 2 |
| Cat brier (*Smilax bona-nox*) | 2 |
| Laurel-leaved greenbrier (*Smilax laurifolia*) | 1 |
| Other greenbriers (*Smilax* sp.) | 11 |
| Wax myrtle (*Myrica cerifera*) | 1 |
| Bayberries (*Myrica carolinensis*) | 7 |
| Chinquapin (*Castanea pumila*) | 1 |
| Western hackberries (*Celtis occidentalis*) | 5 |
| Other hackberries (*Celtis* sp.) | 3 |
| Figs (*Ficus* sp.) | 1 |
| Mulberries (*Morus* sp.) | 1 |
| Mistletoe berries (*Phoradendron villosum*) | 2 |
| Poke berries (*Phytolacca decandra*) | 16 |
| Miner's lettuce (*Montia perfoliata*) | 1 |
| Sassafras berries (*Sassafras variifolium*) | 2 |
| Spice berries (*Benzoin æstivale*) | 1 |
| Currants (*Ribes* sp.) | 3 |
| Sweet gum (*Liquidambar styraciflua*) | 2 |
| Chokeberries (*Pyrus arbutifolia*) | 1 |
| Service berries (*Amelanchier canadensis*) | 9 |
| Hawthorn (*Cratægus* sp.) | 1 |
| Strawberries (*Fragaria* sp.) | 1 |
| Blackberries or raspberries (*Rubus* sp.) | 5 |
| Rose haws (*Rosa* sp.) | 1 |
| Wild black cherries (*Prunus scrotina*) | 3 |
| Three-seeded mercury (*Acalypha virginica*) | 1 |
| Staghorn sumach (*Rhus typhina*) | 5 |
| Smooth sumach (*Rhus glabra*) | 5 |
| Dwarf sumach (*Rhus copallina*) | 7 |
| Poison ivy (*Rhus radicans*) | 3 |
| Poison oak (*Rhus diversiloba*) | 15 |
| Laurel-leaved sumach (*Rhus laurina*) | 2 |
| Other sumachs (*Rhus* sp.) | 12 |
| Pepper berries (*Schinus molle*) | 15 |
| American holly (*Ilex opaca*) | 9 |
| Black alder (*Ilex verticillata*) | 12 |
| Ink berries (*Ilex glabra*) | 9 |
| Other hollies (*Ilex* sp.) | 7 |
| Strawberry bush (*Euonymus americanus*) | 1 |
| Roxbury waxwork (*Celastrus scandens*) | 1 |
| Supple-jack (*Berchemia volubilis*) | 2 |
| Coffee berries (*Rhamnus californicus*) | 1 |
| Woodbine (*Psedera quinquefolia*) | 10 |
| Frost grapes (*Vitis cordifolia*) | 2 |
| Wild grapes (*Vitis* sp.) | 1 |
| Wild sarsaparilla (*Aralia nudicaulis*) | 1 |
| Flowering dogwood (*Cornus florida*) | 32 |
| Rough-leaved dogwood (*Cornus asperifolia*) | 2 |
| Black gum (*Nyssa sylvatica*) | 2 |
| Checkerberry (*Gaultheria procumbens*) | 1 |
| Huckleberries (*Gaylussacia* sp.) | 1 |
| Blueberries (*Vaccinium* sp.) | 12 |
| Black nightshade (*Solanum nigrum*) | 4 |
| Bittersweet (*Solanum* sp.) | 4 |
| Goose grass (*Galium aparine*) | 1 |
| Honeysuckle (*Lonicera* sp.) | 2 |
| Indian currant (*Symphoricarpos orbiculatus*) | 1 |
| Downy arrowwood (*Viburnum pubescens*) | 1 |
| Nanny berries (*Viburnum lentago*) | 2 |
| Black elderberries (*Sambucus canadensis*) | 4 |
| Red elderberries (*Sambucus pubens*) | 3 |
| Fruit not further identified | 60 |

In looking over this list one is impressed with the fact that the taste of human beings for fruit differs markedly from that of birds. For example, *Rhus* seeds are hard and have little pulp to render them palatable or nutritious. They are usually passed through the alimentary canal of birds or regurgitated unharmed, and the slight outer coating alone is digested. In the case of the poisonous species, this outer coating is a white wax or tallow which appears to be very nutritious, for these species are eaten much more extensively than

the nonpoisonous ones. The seed itself is rarely broken in the stomach to get any nutriment it may contain. But in spite of these facts *Rhus* seeds were found in 49 stomachs, while fruits of huckleberries and blueberries, which are delicious to the human taste, were found in only 13 stomachs; and blackberries and raspberries, highly esteemed by man, were found in only 5 stomachs. Next to *Rhus* the fruit most eaten was the dogwood berry, found in 34 stomachs, yet from a human estimate these berries are distasteful and contain such large seeds that they afford but very little actual food.

*Summary.*—The hermit thrush, as it name indicates, is of solitary habits and neither seeks human companionship nor molests cultivated products. It destroys nothing indirectly helpful to man, as beneficial insects, but aids in the destruction of the myriad hosts of insect life which at all times threaten vegetation. While it is not easy to point out any especially useful function of the hermit thrush, it fills its place in the economy of nature, from which it should not be removed.

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